

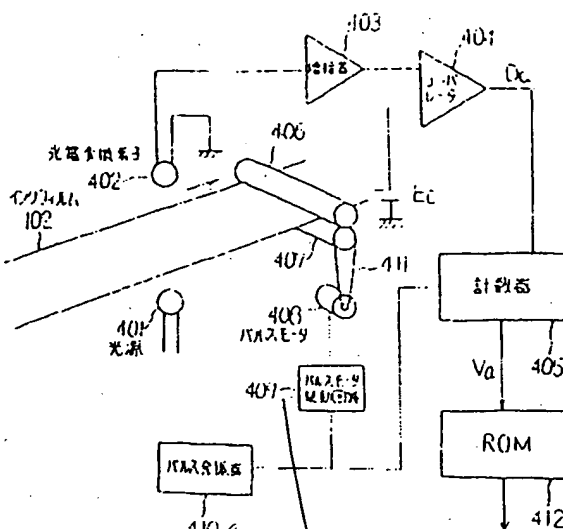
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INVENTOR : KOTO HAJIME

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TITLE : INK COLOR DETECTOR



*oscillator*  
*pulse motor*  
*rotating at fixed angular*  
*velocity*

ABSTRACT : PURPOSE: To reduce the size of an optical system and facilitate adjustment of positions of a light source and a photoelectric converting element, by a method wherein light from a light source is received by a photoelectric converting element through an ink film, a counter is initialized or operated in accordance with the magnitude of a signal from the element, and the color of the ink film is discriminated by a numerical value outputted from the counter.

CONSTITUTION: The ink film 102 is coated sequentially with yellow magenta, cyan and black inks in the longitudinal direction thereof, and the photoelectric converting element 402 is provided on the upper side of the ink film 102 so that the light source 401 and the element 402 are arranged on a substantially straight line. An output from the element 402 is inputted to one terminal of a comparator 404, while a reference voltage source Ec is connected to the other terminal of the comparator 404, and an output Da from the comparator 404 becomes '0' or '1'. The output is sent to the counter 405. On the other hand, a pulse motor 408 is rotated at a fixed angular velocity in synchronism with the oscillating period of a pulse oscillator 410, the counter 405 counts the number of output pulses from the oscillator 410 when the output Da from the comparator 404 is '1', and the counter 405 is initialized to '0' when the output Da from the comparator 404 is '0'. The counted value is sent to a ROM 412.

## ⑫ 公開特許公報(A)

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審査請求 未請求 発明の数 1 (全6頁)

⑭ 発明の名称 インク色検出装置

⑯ 特 願 昭60-16398

⑰ 出 願 昭60(1985)2月1日

⑱ 発 明 者 厚 東 肇 東京都港区芝5丁目33番1号 日本電気株式会社内

⑲ 出 願 人 日本電気株式会社 東京都港区芝5丁目33番1号

⑳ 代 理 人 弁理士 芦 田 坦 外2名

## 明 細 書

## 1. 発明の名称

インク色検出装置

## 2. 特許請求の範囲

1. 感熱転写性の単色インクを少なくとも2色  
塗布したインクフィルムの色を検出する装置<sup>において</sup>  
て、前記インクフィルム的一方の側に配置され  
単色光を前記インクフィルムに向け投射する単色  
光発生手段及び他方の側に配置され前記投射され  
た単色光の透過量を検知する光電変換素子の組合  
せであって、而してこの組合せの光学的特性を前  
記単色光の透過量が前記少なくとも2つの単色イ  
ンクのうちのいずれか1つの選ばれた単色インク  
に対して特に大きくなるか又は小さくなるように  
した光検出部と、前記光電変換素子の出力を前記  
選ばれた単色インクの場合とその他の単色インク  
の場合とで互いに異なる2種類の信号に変換し、  
これら2信号の変化点から少なくとも前記選ばれ

た単色インクの1塗布長を検知できる信号処理手  
段と、前記単色インクが少なくとも3つの場合にお  
いて前記検知した1塗布長と各単色インクの塗布  
長実測値とから、前記その他の単色インクの各1  
塗布長を示す信号を発する計算手段とを備え、こ  
れにより前記インクフィルム上の色を検出するこ  
とを特徴とするインク色検出装置。

## 3. 発明の詳細な説明

〔発明の属する技術分野の説明〕

本発明は感熱転写カラー記録装置に用いられる  
色検出装置の改良に関する。

〔従来技術とその問題点〕

近時、保守が不要で低価格のカラー印刷装置と  
して、感熱転写型のカラー印刷装置が注目されて  
いる。

第2図は従来はこの種のカラー印刷装置の基本  
的な構成を示す図であって、複数の発熱抵抗体が  
設けられたサーマルヘッド101と、搬送される  
方向に複数の色の熱溶解性をもつインク、例えば

シアン、マゼンタ、イエロー、ブラックの順にインクが塗り分けられたインク担体としてのインクフィルム102と、このインクフィルム102から、インクを転写される記録体としての記録紙103と、順次搬送されるインクフィルム102上のインクの色を検出する色検出装置104とから構成される。

記録を行なうには画像情報をインクフィルム102上のインクの色ごとに例えばバッファメモリ(図示せず)等に蓄えておき、インク転写位置でサーマルヘッド101、インクフィルム102、記録紙103を圧接させる。そしてインクフィルム102と記録紙103を順次搬送させ、色検出器104で検出した色に応じた画像信号をバッファメモリより読み出してサーマルヘッド101を駆動し、インクフィルム上のインクを溶かして記録紙103に転写させる。

このようにして単色インクに対応する記録が終了したら、サーマルヘッド101、インクフィルム102、記録紙103の圧接状態を解き、イン

(3)

示す図であって、例えば着色していないコンテナ紙又はポリエステルフィルム302上に単色インクのイエローインク301Y、マゼンタインク301M、シアニンク301C、ブラックインク301Bが順に塗布されている。

第3図に戻って、インクフィルム102の上には受光量を電気信号に変換する3個の光電変換素子、例えばフォトトランジスタ204a、204b、204cが設けられ、その出力信号はそれぞれ増幅器205a、205b、205cで増幅されて、コンパレータ206a、206b、206cの一方の端子に接続されている。一方、これらのコンパレータの他の端子には可変抵抗207a、207b、207cを介して基準電圧源 $E_a$ 、 $E_b$ 、 $E_c$ が供給されていて、それぞれ増幅器205a、205b、205cの出力信号と比較され、コンパレータ206a、206b、206cの出力は信号処理回路208に接続され、インクフィルム102上に塗布されたインクの色に応じた電気信号が出力される。

(5)

クフィルム102は次の色のインク層がサーマルヘッド101の下に位置するように、記録紙103は前の単色インク層に対応する記録を行なった領域の先頭がサーマルヘッド101の下に位置するように両者を搬送させる。以下、色検出器104によってインクの色を検出しながら対応した画像信号でサーマルヘッド101を駆動して各単色信号による記録を行なうと1枚のカラー画像が得られる。

第3図は上記のようなカラー印刷装置におけるインクフィルム102の色検出装置の一例を示す図である。第3図において、ランプ201a、201b、201cは例えばタングステンランプ等の光源であり、ランプ201aの前には赤のフィルタ202a、ランプ201bの前には緑のフィルタ202b、ランプ201cの前には青のフィルタ202cがそれぞれ配置され、インクフィルム102に照射される光はそれぞれ赤、緑、青である。

第4図はインクフィルム102の構成の一例を

(4)

上記において、光源201a、フィルタ202a、光電変換素子204aは略一直線上に設けられ、これがひとつの組を成す。光源201b、フィルタ202b、光電変換素子204bの組、光源201c、フィルタ202c、光電変換素子204cの組も同様である。またランプ201a、201b、201cの光はそれぞれフィルタ202a、202b、202cを通してインクフィルム102に照射され、ランプ201aからの光は赤、ランプ201bからの光は青、ランプ201cからの光は緑となる。

インクフィルム102は、第4図に示した様に各単色インクが塗布されており、各インクの色と補色関係にある光以外を透過する。従ってシアンは赤の光を、マゼンタは緑の光を、イエローは赤の光をそれぞれ透過しない。例えばインクフィルム102上の色がマゼンタの場合には、光源201bより緑のフィルタ202bを通過した光は受光素子204bに到達せず、コンパレータ206bの出力 $V_b$ は基準電圧源 $E_b$ 、抵抗207bの適当な設

(6)

定により「0」となる。一方、赤フィルタ202a、青のフィルタ202cを通過した光はそれぞれ受光素子204a、204cに到達し、抵抗207a、207cと基準電圧源 $E_a$ 、 $E_c$ の適当な設定によりコンパレータ206a、206cからの出力 $V_a$ 、 $V_c$ は「1」となる。

従って、インクフィルム102上に塗布されたインクの色により、コンパレータ206a、206b、206cの出力 $V_a$ 、 $V_b$ 、 $V_c$ はそれぞれ「0」または「1」となり、信号処理回路208に入力されてこの回路内で演算され、各インクフィルム上のインクの色に応じた数値が出力され、インクフィルム102上のインク色を数値で識別することが可能となる。このような構成の色検出装置の出力により、第2図で説明した様に感熱転写装置はインクフィルム102上のインク色に対応した画像信号をサーマルヘッドに供給して駆動し、インクフィルム102上のインクを溶かして記録紙に転写させる。

しかしながら、上記の様な色検出装置の構成で

(7)

くなるようにした光検出部と、前記光電変換素子の出力を前記選ばれた単色インクの場合とその他の単色インクの場合とで互いに異なる2種類の信号に変換し、これら2信号の変化点から少なくとも前記選ばれた単色インクの1塗布長を検知できる信号処理手段と、前記単色インクが少なくとも3つの場合において前記検知した1塗布長と各単色インクの塗布長実測値とから、前記その他の単色インクの各1塗布長を示す信号を発する計算手段とを備え、これにより前記インクフィルム上の色を検出することを特徴とするインク色検出装置が得られる。

#### 〔発明の実施例〕

次に図面を参照しながら、実施例を具体的に説明する。第1図は本発明の実施例を示す。まず主として構造と各部の機能について説明する。第1図において、インクフィルム102は圧接されたローラ406、407の回転により矢印の方向に搬送される。インクフィルム102は第4図に説明したように長手方向にイエロー、マゼンタ、シ

(9)

アン、ブラックの各インクが順に塗布されており、インクフィルム102の面に略垂直に設けられていて、その上側には例えばフォトリソスタ等の光電変換素子402が設けられ、光源401、光電変換素子402は略一直線上に設けられ、一対の組を成している。発熱抵抗体(第2図の101)は搬送ローラ406の図で右前方にあるが、第1図では省略してある。

#### 〔発明の目的〕

したがって本発明の目的は、従来の技術における上記事情を考慮し、上記の欠点を解決し、簡単な構成で的確にインクフィルムの色識別ができる新規な装置を提供することにある。

#### 〔発明の構成〕

本発明によれば、感熱転写性の単色インクを少なくとも2色塗布したインクフィルムの色を検出する装置であって、前記インクフィルム<sup>にかい</sup>の一方の側に配置され単色光を前記インクフィルムに向け投射する単色光発生手段及び他方の側に配置され前記投射された単色光の透過量を検知する光電変換素子の組合せであって、而してこの組合せの光学的特性を前記単色光の透過量が前記少なくとも2つの単色インクのうちのいずれか1つの選ばれた単色インクに対して特に大きくなるか又は小さ

(8)

く、光源401は例えばタングステンランプ等の光源であり、インクフィルム102の面に略垂直に設けられていて、その上側には例えばフォトリソスタ等の光電変換素子402が設けられ、光源401、光電変換素子402は略一直線上に設けられ、一対の組を成している。発熱抵抗体(第2図の101)は搬送ローラ406の図で右前方にあるが、第1図では省略してある。

光電変換素子402の出力は増幅器403で増幅され、コンパレータ404の一方の端子に入力される。またコンパレータ404の他方の端子には基準電圧源 $E_c$ が接続されている。このコンパレータ404は基準電圧源 $E_c$ と増幅器403からの信号電圧を比較し、コンパレータ404の出力 $D_a$ は「0」または「1」となる。この出力は計数器405に送られる。

パルスモータ408はパルス発振器410の出力をパルスモータ駆動回路409を介して駆動さ

(10)

れ、ベルト411を介してローラ407を回転させ、上述したようにローラ406とともにインクフィルム102を搬送させる。パルスモータ駆動回路409は外部から作動、停止ができる。パルスモータ408はパルス発振器410の発振周期に同期して一定の角速度で回転しているので、インクフィルム102はパルス発振器410の発振周期に同期して搬送される。また、発振器410の出力は計数器405にも接続されている。計数器405はコンパレータ404の出力 $D_A$ の値が「1」のとき発振器410の出力パルス数を計数し、「0」のときに初期化されて「0」となる。この計数値は読出し専用メモリ412に送られる。

次に動作について説明すると、搬送されるインクフィルム102には光源401から光が照射され、インクフィルム102上に塗布されたインクの色により光源の透過率が異なる。すなわちシアインク塗布部分は赤色以外の光、マゼンタインク塗布部分は緑色以外の光、イエローインク塗布部分は青色以外の光の透過率が大きく、ブラック

(11)

チより算出した値であり、 $N_1$ 、 $N_2$ もそれぞれマゼンタ、イエローの塗布長を実測して求めた値です。従って、表1の様にROM412の内容を定めておくと、ブラックインク塗布部分では計数器405の出力は「0」となってROM412よりデータ0が出力される。次いでシート搬送によりブラックインク塗布部分が発光素子401と受光素子402を結ぶ略一直線の光ビームの位置を通過すると計数器405は発振器410のパルス出力を計数し、その出力信号 $V_A$ が $N_1$ 、 $N_2$ 、 $N_3$ となるに従ってROM412の出力は1、2、3となってブラック以外の各塗布インクの色に応じた出力が得られ<sup>る</sup>。そして再びブラックインク塗付部になれば計数器は初期され、以て前記と同じような動作を繰返す。

またインクフィルムが上記インクフィルム102よりもさらに簡略化され、イエロー、マゼンタ、シアンの3色が長手方向に塗布されている場合には、第1図において、光源401のかわりにイエロー、マゼンタ、シアンのいずれかの色と補色関

(13)

インクの塗布部分は赤色、緑色、青色成分のいずれも透過率が小さい。従って光電変換素子402の受光量をインクフィルム102上の色がブラックである場合最も小さくなる。従って、基準電圧源 $E_c$ を適当な設定にすることにより、インクフィルム102上の色がブラックの場合、コンパレータの出力 $D_A$ を「0」、他の色の場合「1」とする。これにより計数器5はブラックインクの部分で初期化されて、その出力は「0」となり、他のインク部分で発振器410の出力パルスを計数し、計数した数値をROM412に送出する。

ここでROM412のデータを下記のように定めておく。

表 1

| 番 地 | 0 | 1~ $N_1$ | $N_1+1$ ~ $N_2$ | $N_2+1$ ~ $N_3$ |
|-----|---|----------|-----------------|-----------------|
| データ | 0 | 1        | 2               | 3               |

表1において、 $N_1$ はシアンの塗布長をあらかじめ実測しておいてインクシート102の搬送ピッ

(12)

係にある光を発する補色光源を用いればよい。例えば光源を赤色で発光するLEDを用いた場合、或いは別の光源とフィルタを組合わせて赤色光を用いた場合、前記で述べたようにインクフィルム上の色がシアンの場合、赤色光と補色関係にあるために、受光素子への受光量が最も小さくなる。従って第1図において、基準電圧源 $E_c$ を適切に設定し、インクフィルム上の色がシアンの場合、コンパレータ出力 $D_A$ を「0」とし、他の色の場合「1」となるようにする。

このようにして、計数回路405がインクフィルム上のシアンが通過する毎にクリアされるようにして、次のイエローより計数を開始するようにすれば、上述の実施例と同様にして、インクシート上の色を計数回路405の出力値で識別することができる。

以上の実施例で説明したように、インクフィルム上のインクの色を数値で識別することが出来るので、実際の記録装置内の制御系は次にどの色を記録するか、どうか分かり、対応した画像信号

(14)

でサーマルヘッドを駆動することができる。

なお上記の実施例は特定の1つの色の塗布長を求めるのに、投射光としてそのインク色で最も遮られ易い補色のものを用いているが、2番目に説明したようなブラック色のない場合は、投射光としてインク色と同色のものを用い、コンパレータ404と基準電圧を適当に設定すれば出力信号として特定のインク色の場合に「0」、その他の場合に「1」を発生させることができる。また計数器405は前述したようにインクシート102上の色が特定の色の場合に初期化されるために、例えばインクフィルム102の搬送ピッチの精度やインクフィルム102の各色インクの塗布長誤差によって生じる各色インク塗布長に対する計数器405の計数誤差の累積も少ない。さらに、インクフィルム上のインクの塗布長が変化しても計数回路の数値が変化するだけで容易に対応出来、インクフィルム上の各インク色の塗布順序の変化にも対応出来る。

以下余白

(15)

412は読出専用メモリ(ROM)をそれぞれあらわしている。

代理人 (7127) 弁理士 後藤 洋介



# [ 発明の効果 ]

本発明は、以上説明したように、光学系は1組の光源と光電変換素子を用いて光源からの光をインクフィルムを通して光電変換素子で受光し、インクフィルムの透過光量によって、つまり光電変換素子の信号の大小によって計数器を初期化または動作させてインクフィルム上の色を計数器の出力数値で識別できるので、光学系が小型に出来、光源と光電変換素子の位置調整も容易となる。

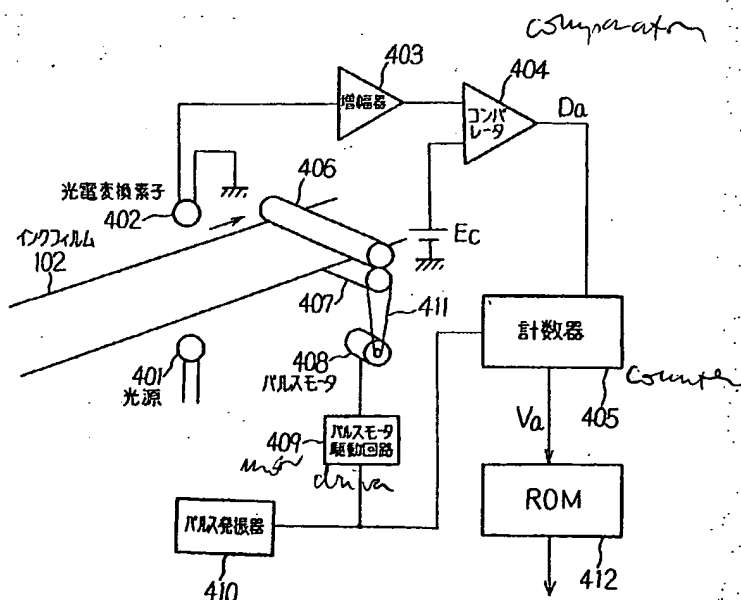
## 4. 図面の簡単な説明

第1図は本発明の一実施例の構成の概略を示す図、第2図は感熱転写型カラー印刷装置の原理を示す概略斜視図、第3図は従来の色識別装置の構成図、第4図はインクフィルムの斜視図である。

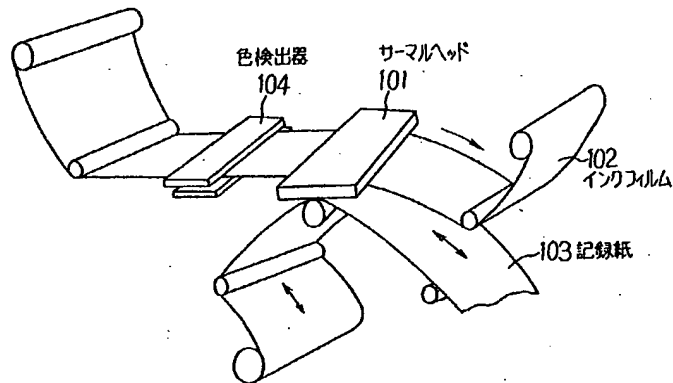
記号の説明：102はインクフィルム、401は光源、402は光電変換素子、403は増幅器、404はコンパレータ、405は計数器、406、407はローラ、408はパルスモータ、409はパルスモータ駆動回路、410はパルス発振器、

(16)

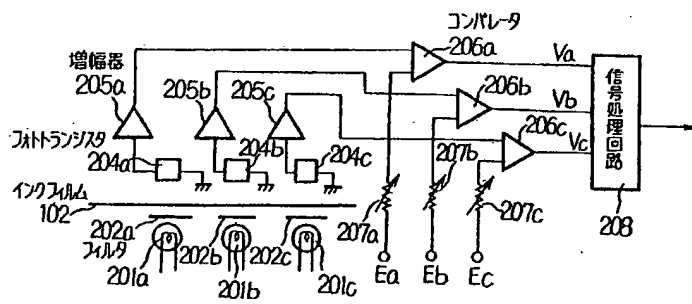
第1図



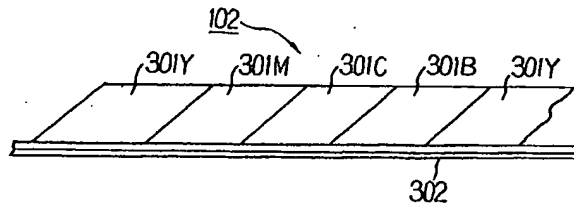
第2図



第3図



第4図



## TRANSLATION FROM JAPANESE

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(54) Title of the Invention

Ink Color Detection System

(21) Application No: Sho 60-16398

(22) Filing Date: Feb. 1, 1985

(72) Inventor: Hajime Koto, employee of  
NEC Corp.  
33-1, Shiba 5-chome  
Minato-ku, Tokyo

(71) Applicant: NEC Corp.  
33-1, Shiba 5-chome  
Minato-ku, Tokyo

(74) Agent: Akira Ashida, patent attorney  
(and two others)

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## Specification

### 1. Title of the Invention

Ink Color Detection System

### 2. Claims

1. In a system in which the colors of an ink film on which at least two colors of heat-sensitive transferable monochromatic ink has been coated are detected,

an ink color detection system characterized in that it is equipped with

a monochromatic light generating means that is disposed on one side of the previously mentioned ink film and with which monochromatic light is projected toward the previously mentioned ink film, and

a light detection section that is disposed on the other side and which is a combination of photoelectric conversion elements with which the transmitted amount of the previously mentioned projected monochromatic light is detected and, moreover, the optical characteristics of the combination are made so that the previously mentioned amount of monochromatic transmitted light becomes particularly large or becomes particularly small with respect to one of the monochromatic inks that has been selected from among the previously mentioned at least two monochromatic inks, and

a signal processing means with which the outputs of the previously mentioned photoelectric conversion elements are converted into two differing types of signals for the case of the previously mentioned monochromatic ink that has been selected and for the case of another monochromatic ink, and with which, from the transition point of these two signals, it is possible

to detect at least one coating length of the previously mentioned monochromatic ink that has been selected, and

a calculation means with which, in those cases where there are at least three of the previously mentioned monochromatic inks, from the previously mentioned one coating length that has been detected and the actual measured value of the coating length of each monochromatic ink, a signal is generated that indicates the one coating length for each of the previously mentioned other monochromatic inks, and

by this means, the colors on the previously mentioned ink film are detected.

### 3. Detailed Description of the Invention

#### <Field of Industrial Utilization>

The present invention relates to the improvement of a color detector that is used in a heat-sensitive transfer color recording system.

#### <Prior Art and Problems of Prior Art To Be Addressed by the Invention>

In recent times, heat-sensitive transfer types of color printing systems have been the focus of attention as color printing systems that do not require maintenance and are low cost.

Fig. 2 is a drawing that shows the basic structure of this kind of color printing system of the past. It comprises the thermal head 101 in which a plurality of heat generating resistance units are disposed, the ink film 102, which is an ink carrier with which inks in a plurality of colors that possess thermal fusion properties are coated divided in the direction of transport and in the order of, for example, cyan, magenta, yellow, and black, the recording paper 103, which is the recording medium to which the ink is transferred, and the color detection system with which the colors of the inks on the ink film 102 that are successively transported are detected.

In order to carry out the recording, the image data is stored in, for example, a buffer memory (not shown in the drawing) or the like for each of the colors of ink on the ink film 102 and pressure contact is applied to the thermal head 101, the ink film 102, and the recording paper 103 at the ink transfer location. Then, then the ink film 102 and the recording paper 103 are successively transported, an image signal that conforms to the color that has been detected by the color detector 104 is read out from the buffer memory, the thermal head 101 is driven, and the ink on the ink film is melted and transferred to the recording paper 103.

When it is done in this manner, after the recording that corresponds to one color of ink has been completed, the pressure contact state of the thermal head 101, the ink film 102, and the recording paper 103 is canceled, and both the ink film 102 and the recording paper 103 are transported so that the next ink color layer is positioned under the thermal head 101 and so that the beginning of the region in which recording has been carried out that corresponds to the layer of the previous monochromatic ink color is positioned under the thermal head 101. Following this, the thermal head 101 is driven by the corresponding image signal while the colors of the inks are detected by the color detector 104 and, when the recording has been carried out in accordance with each of the monochromatic signals, a single color image is obtained.

Fig. 2 is a drawing that shows one example of a color detection system for the ink film 102 in a color printing system such as that described above. In Fig. 3, the lamps 201a, 201b, and 201c are light sources such as, for example, tungsten lamps. The red filter 202a is placed in front of the lamp 201a, the green filter 202b is placed in front of the lamp 201b, and the blue filter 202c is placed in front of the lamp 201c, and the lights that are shone on the ink film 102 are respectively red, green, and blue.

Fig. 4 is a drawing that shows one example of the structure of the ink film 102. For example, the monochromatic inks of the yellow ink 301Y, the magenta ink 301M, the cyan ink 301C, and the black ink 301B are coated in order on uncolored condensor paper or polyester film 302.

Returning to Fig. 3, the photoelectric conversion elements, such as, for example, the phototransistors 204a, 204b, and 204c, with which the amount of light that is received is converted into an electrical signal, are disposed above the ink film 102. Their output signals are respectively amplified by the amplifiers 205a, 205b, and 205c and are connected to one terminal of the comparators 206a, 206b, and 206c. On the other hand, the standard voltage sources  $E_a$ ,  $E_b$ , and  $E_c$  are supplied to the other terminals of these comparators through the variable resistances 207a, 207b, and 207c and compared with the output signals from each of the amplifiers 205a, 205b, and 205c. The outputs of the comparators 206a, 206b, and 206c are connected to the signal processing circuit 208 and an electrical signal that corresponds to the color of the ink that has been coated on the ink film 102 is output.

In the above description, the light source 201a, the filter 202a, and the photoelectric conversion element 204a are shown disposed roughly along a single straight line and this comprises a single group. In the same manner, there are also the group of the light source 201b, the filter 202b, and the photoelectric conversion element 204b and the group of the light source 201c, the filter 202c, and the photoelectric conversion element 204c. In addition, the light from each of the lamps 201a, 201b, and 201c respectively passes through the filters 202a, 202b, and 202c and shines on the ink film 102. The light from the lamp 201a becomes red, the light from the lamp 201b becomes blue and the light from the lamp 201c becomes green [sic: in the description of the lamps and filters above, 201b is green and 201c is blue].

With regard to the ink film 102, as has been shown in Fig. 4, each monochromatic ink is coated on it, and everything passes through other than the light that has a complimentary color relationship with each ink color. Accordingly, cyan will not pass the red light, magenta will not pass the green light and yellow will not pass the red [sic: should be blue] light. For example, in the case where the color on the ink film 102 is magenta, the light from the light source 201b that has passed through the green filter 202b does not reach the light receiving element 204b and the output  $V_b$  of the comparator 206b is made "0" by means of an appropriate setting of the standard voltage source  $E_b$  and the resistance 207b. On the other hand, the lights that have passed through

the red filter 202a and the blue filter 202c reach, respectively, the light receiving elements 204a and 204c and the outputs  $V_a$  and  $V_c$  from the comparators 206a and 206c are made "1" by means of the appropriate settings of the resistances 207a and 207c and the standard voltage sources  $E_a$  and  $E_c$ .

Consequently, the outputs  $V_a$ ,  $V_b$ , and  $V_c$  from the comparators 206a, 206b, and 206c become "0" or "1" due to the colors of the ink that has been coated on the ink film 102. These are input to the signal processing circuit 208 and are operated on in that circuit. A numerical value is output in conformance with each of the colors of the ink on the ink film, and it becomes possible to identify the ink color on the ink film 102 by means of the numerical value. By means of the output of a color detection system having a configuration such as this, as has been explained in the case of Fig. 2, in the heat-sensitive transfer system, an image signal that conforms to the ink color on the ink film is supplied to and drives the thermal head, and the ink on the ink film 102 is melted and transferred to the recording paper.

However, with a color detection system that is configured as described above, there is a weakness that, since three light sources, three kinds of filters, and three light receiving elements are required, the scale of the optical system is large and the positioning adjustment of each light source, filter, and light receiving element becomes complicated.

#### <Object of the Invention>

Therefore, the object of the present invention is to provide a new system that takes the above mentioned situation with regard to the technology of the past into account, solves the above mentioned weakness, has a simple structure, and can accurately identify the colors of the ink film.

#### <Structure of the Invention>

By means of the present invention, in a system in which the colors of an ink film on which at least two colors of heat-sensitive transferable monochromatic ink has been coated are detected,

an ink color detection system can be obtained that is characterized in that it is equipped with a monochromatic light generating means that is disposed on one side of the previously mentioned ink film and with which monochromatic light is projected toward the previously mentioned ink film, and a light detection section that is disposed on the other side and which is a combination of photoelectric conversion elements with which the transmitted amount of the previously mentioned projected monochromatic light is detected and, moreover, the optical characteristics of the combination are made so that the previously mentioned amount of monochromatic transmitted light becomes particularly large or becomes particularly small with respect to one of the monochromatic inks that has been selected from among the previously mentioned at least two monochromatic inks, and a signal processing means with which the outputs of the previously mentioned photoelectric conversion elements are converted into two differing types of signals for the case of the previously mentioned monochromatic ink that has been selected and for the case of another monochromatic ink, and with which, from the transition point of these two signals, it is possible to detect at least one coating length of the previously mentioned monochromatic ink that has been selected, and a calculation means with which, in those cases where there are at least three of the previously mentioned monochromatic inks, from the previously mentioned one coating length that has been detected and the actual measured value of the coating length of each monochromatic ink, a signal is generated that indicates the one coating length for each of the previously mentioned other monochromatic inks, and by this means, the colors on the previously mentioned ink film are detected.

#### <Exemplary Embodiments of the Invention>

Next, an explanation will be given of a specific exemplary embodiment while referring to the drawings. Fig. 1 shows an exemplary embodiment of the present invention. First, an explanation will be given of the major structure and the functions of each section. In Fig. 1, the ink film 102 is transported in the direction of the arrow by means of the rotation of the rollers 406 and 407 that are in pressure contact. The ink film 102 is, as was explained with Fig. 4, coated in order in the longitudinal direction with yellow, magenta, cyan, and black inks. The light source 401 that is disposed below the ink film is a light source such as, for example, a tungsten lamp and is

disposed roughly perpendicular to the surface of the ink film 102. A photoelectric conversion element 402 such as, for example, a phototransistor is disposed above that and the light source 401, and the photoelectric conversion element 402 are disposed in roughly a straight line and form a paired group. The heat generating resistance units (101 in Fig. 2) are on the right front of the drawing of the transport roller 406, but they are omitted from Fig. 1.

The output of the photoelectric element 402 is amplified by the amplifier 403 and input to one of the terminals of the comparator 404. In addition, the standard voltage source  $E_c$  is connected to the other terminal of the comparator 404. The comparator 404 compares the standard voltage  $E_c$  and the voltage of the signal from the amplifier 403. The output  $D_a$  of the comparator 404 becomes "0" or "1." This output is sent to the counter 405.

The pulse motor 408 is driven by the output of the pulse generator 410 through the pulse motor driver circuit 409, the roller 407 is rotated through the belt 411 and, in the manner discussed above, transports the ink film 102 together with the roller 406. The pulse motor driver circuit 409 is operated externally and can be stopped. Since the pulse motor 408 is synchronized with the oscillation frequency of the pulse oscillator 410 and rotates at a fixed angular velocity, the ink film 102 is transported synchronized with the oscillation frequency of the pulse oscillator 410. In addition, the output of the oscillator 410 is also connected to the counter 405. The counter 405 counts the output pulses of the oscillator 410 when the value of the output  $D_a$  of the comparator 404 is "1" and is initialized to "0" when it is "0." The count value is sent to the read only memory 412.

Next an explanation will be given regarding the operation of the exemplary embodiment. Light from the light source 401 is shone on the ink film 102 that is transported, and the percentage of light that passes through the ink film 102 differs depending on the color of the ink that is coated on it. That is to say, the light transmittance is greater for colors other than red for the portion that is coated with cyan ink, it is greater for colors other than green for the portion that is coated with magenta ink, and it is greater for colors other than blue for the portion coated with yellow ink.

For the portion coated with black ink, the light transmittance is low for all of the components of red, green and blue. Accordingly, in those cases where the color on the ink film 102 is black, the amount of light that is received by the photoelectric conversion element 402 also becomes low. Therefore, by means of an appropriate setting of the standard voltage source  $E_c$ , it is made so that the output  $D_a$  of the comparator is "0" in those cases where the color on the ink film 102 is black and "1" in those cases where it is another color. By this means, the counter 5 [sic: should be 405] is initialized by the sections of black ink, and its output becomes "0." For other ink sections, the output pulses of the oscillator 410 are counted and the count value that has been calculated is sent to the ROM 142 [sic: should be 412].

At this point, the data of ROM 412 is arranged as listed below.

Table 1

| Number | 0 | 1 to $N_1$ | $N_1 + 1$ to $N_2$ | $N_2 + 1$ to $N_3$ |
|--------|---|------------|--------------------|--------------------|
| Data   | 0 | 1          | 2                  | 3                  |

In Table 1,  $N_1$  is a value that is calculated from the coating length for cyan that has been measured in advance and the transport pitch of the ink sheet [sic] 102, while  $N_2$  and  $N_3$  are values that have been derived from the measurements of the coating lengths for magenta and yellow respectively. Accordingly, when the contents of the ROM 412 are arranged as in Table 1, the output of the counter 405 becomes "0" in the black ink coated sections and data of 0 are output from the ROM 412. Next, when the black ink coated section has passed through the position of the light beam that is roughly a straight line linking the light generating element 401 and the light receiving element 402 due to the sheet transport, the counter 405 counts the pulse output of the oscillator 410, the output of the ROM 412 becomes 1, 2, or 3 in accordance with whether the output signal  $V_a$  is  $N_1$ ,  $N_2$ , or  $N_3$ , and an output is obtained in conformance with the colors of each of the coated inks other than black. Then, when a black ink coated portion again appears,

the counter is initialized and, by this means, the same sort of operation described before is repeated.

In addition, in those cases where the ink film is even more simplified than the above mentioned ink film 102 and is coated with the three colors of yellow, magenta, and cyan in the longitudinal direction, a complimentary color light source with which light is generated that has a complimentary relationship with one of the colors of yellow, magenta, or cyan may be employed instead of the light source 401 in Fig. 1. For example, in a case where an LED that generates red light is employed as the light source, or in a case where another light source and a filter are combined and a red colored light is used, when, as was discussed above, the color on the ink film is cyan, because there is a complimentary relationship with the red colored light, the amount of light received by the light receiving element is at its lowest. Accordingly, in Fig. 1, it has been set up so that, in a case where the standard voltage  $E_c$  has been set appropriately and the color on the ink film is cyan, the comparator output  $D_a$  is "0" and in the case of other colors, it becomes "1."

Doing it in this manner, if it is set up so that the counter circuit 405 is cleared each time that the cyan on the ink film passes through and so that the counting starts from the next yellow, in the same manner as in the exemplary embodiment discussed above, it is possible to identify the color on the ink sheet by means of the output value of the counter circuit 405. As was explained in the case of the exemplary embodiment above, since it is possible to identify the color of the ink on the ink film by means of the count value, no matter which color is the next to be recorded by the control system in an actual recording device and no matter how it is realized, it is possible to drive the thermal head by means of the corresponding image signal.

Incidentally, even though, in the above mentioned exemplary embodiment, the coating length of a specified single color is derived and the complementary color which is the easiest to be interrupted by the ink color is used as the projected light, as was shown in the second explanation, in the case where there is no black color, it is possible to employ something that is the same color as the ink color for the projected light. If the comparator 404 and the standard

voltage are set appropriately, a "0" will be generated as the output signal in the case of the specified ink color and a "1" will be generated in other cases. In addition, because the counter 405 is, as was discussed before, initialized when the specified color is on the ink sheet 102, for example, the cumulative count error of the counter 405 is also small with respect to each of the ink coating lengths that is produced due to such things as ink film 102 transport pitch accuracy and coating length errors for each of the colored inks of the ink film 102. Furthermore, even if the coating length of the ink on the ink film should change, it can be easily coped with by merely changing the count value of the counter circuit and even a change in the coating order for each of the ink colors on the ink film can be coped with.

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#### <Advantageous Result of the Invention>

With the present invention, as has been explained above, a single optical system group comprising a light source and a photoelectric conversion element is employed and the light from the light source passes through the ink film and is received by the photoelectric conversion element. Since the counter is initialized or operated by the amount of light that passes through the ink film, in other words, by the size of the signal from the photoelectric conversion element and it is possible to identify the color on the ink film by means of the counter output count value, the position adjustment of the light source and the photoelectric conversion element becomes simple.

#### 4. <Brief Description of the Drawings>

Fig. 1 is a drawing that shows an outline of the structure of one exemplary embodiment of the present invention;

Fig. 2 is an oblique view outline drawing that shows the principles of a heat-sensitive transfer type color printing system;

Fig. 3 is a structural drawing of a color identification system of the past; and

Fig. 4 is an oblique view drawing of the ink film.

Explanation of the Keys:

- 102 indicates the ink film
- 401 indicates the light source
- 402 indicates the photoelectric conversion element
- 403 indicates the amplifier
- 404 indicates the comparator
- 405 indicates the counter
- 406 and 407 indicate the rollers
- 408 indicates the pulse motor
- 409 indicates the pulse motor driver circuit
- 410 indicates the pulse oscillator
- 412 indicates the read only memory (ROM)

Agent: (7127) Akira Ashida, patent attorney

Fig. 1

- 102 ink film
- 401 light source
- 402 photoelectric conversion element
- 403 amplifier
- 404 comparator
- 405 counter
- 408 pulse motor
- 409 pulse motor driver circuit
- 410 pulse oscillator

Fig. 2

- 101 thermal head
- 102 ink film
- 103 recording paper
- 104 color detector

Fig. 3

- 102 ink film
- 202a filter
- 204a phototransistor
- 205a amplifier
- 206a comparator
- 208 signal processing circuit